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IN TWO SECTIONS

## Section I

# Accounting in the Aircraft Industry

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## Accounting in the Aircraft Industry


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## EDITORIAL DEPARTMENT NOTE

In any relatively new industry, accounting problems are usually solved by a generous mixture of experience in similar industries and common sense. However, the business of transportation of passengers and mail by air is one that is so radically different from other industries that there is very little available experience that is helpful. Hence the solution of the accounting problems created by this type of business rest very largely on the sound judgment of the accounting pioneers who are actively engaged in it. We are particularly fortunate in being able to present the findings of one of these pioneers who has been actively engaged in the airplane field long enough to appreciate its accounting problems and suggest a solution of many of them.

John S. Woodbridge, the author of this paper, after service with the Allied forces during the World War, completed his college work and graduated from Princeton. Following approximately three years of varied occupations, he became associated with Loomis, Suffern & Fernald, certified public accountants, in November, 1922, working with that organization in New York City and in Birmingham, Alabama until September, 1929. At that time, he joined Avaiation Corporation of the Americas, which through Pan American Airways, Inc., and other subsidiaries, operates mail and passenger airlines in the United States, the West Indies, Mexico and Central and South America. Mr. Woodbridge is now Treasurer of the two companies just mentioned.

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## ACCOUNTING IN THE AIRCRAFT INDUSTRY

THE prime element of aviation is speed, and that is undoubtedly what your genial president considered when he asked me to exhaust in the space of half an hour the all-inclusive topic of "Accounting in the Aircraft Industry". If any one of you in this audience of specialized accountants and economists should be asked to cover thoroughly in thirty minutes the subject of "Cost Accounting", I believe that that highly honored individual would understand my position. He would unquestionably do as I intend to do, and divert a portion of the broad general stream into unusual or controversial channels, dismissing the better-known and accepted matters with a few words.

The aircraft industry can be divided into four well-defined groups, engaged in, first, the manufacture of flying and ground equipment, second, the transport of mail, third, the transport of passengers, and fourth, the rendering of miscellaneous services in connection with the industry.

Accounting methods employed by companies engaged in the manufacture of airplanes, engines and parts follow approved and time-honored lines, with the ordinary amount of quarreling over the questions of charging interest on investment, of pricing of work-in-process and of other acrimonious subjects. At this point, allow me to present the first of the controversial points promised. A company engaged in the manufacture of large airplanes found itself at the end of its fiscal year in the position of having delivered several airplanes on a two million dollar contract, of having partially completed several other airplanes and of having the balance of the contract only on paper and in the minds of the directors as a golden dream. This fortunate company was asked to prepare an annual statement for the Exchange and for the stockholders, but could not decide how to handle the matter of the cost of the airplanes actually delivered. For weeks the company debated as to whether it should be considered that a profit had been made on the delivered portion of the contract or whether the contract should be treated as a whole and the delivered airplanes carried in the inventory at cost. It took the combined efforts of an adamant Board of Directors, an elusive Federal income tax law and a firm of thoughtful Certified Public Accountants

finally to settle the question, which is a question met constantly in contractual accounting.

No attempt will be made at this time to discuss the accounting methods employed in the various forms of miscellaneous aerial service. The mere mention of a few of such activities will produce in your minds images of the necessary ledger accounts, printed forms and financial statements.

Aerial photography, in connection with mapping, surveying, civic planning, prospecting and similar operations produces technical problems of great interest, involving many difficulties in covering the terrain adequately with sufficient but not excessive overlap of picture.

Crop protection provides for the distribution of insecticide in such a manner that insect pests are exposed to the poison with the desired results. This has been very helpful in the Southern states, in the campaign against the boll weevil and the corn borer, and is at the present time being used in Northern Africa, in a desperate attempt to combat the plague of locusts.

Fast express and perishable merchandise is often transported by air, when delay is of serious consequence. A good illustration of this is that of a sugar plantation which breaks a part of its machinery in the grinding season and has no duplicate on hand. The natural answer is the cable station and the air transport companies.

Payroll transportation has been used in some bandit-infested countries where insurance rates on payroll robbery are prohibitive.

The subject which I wish to discuss this evening is that of the transportation of mail and passengers by air. In illustrating the accounting methods employed in this class of business, I will use the methods adopted by our company as formulated by its Comptroller, Mr. J. H. Johnston.

A few words as to the scope of the activities of this international air transportation system will enable us better to visualize the situations and problems existing in this form of air service.

Pan American Airways conducts mail and passenger service between the United States and twenty-nine of the countries and colonies of the West Indies, Central America and South America. Our equipment includes in round numbers, a fleet of 75 land airplanes and amphibians, 250 air-cooled engines to supply power to these airplanes and to serve as reserves, 75 airports in operation

and 50 radio control stations in operation, under construction, or under survey. During the year 1929, over 15,000 passengers and 530,000 pounds of international air mail were carried on the routes operated by the Company, involving nearly 3,000,000 miles of flying.

It will be seen that the problems encountered in the establishment of a uniform and adequate system of recording transactions were not lightly to be dismissed with a few thoughtless words to bookkeeping understudies. When it is realized that one of the requirements of the accounting system was that it should provide for the monthly presentation of detailed and complete information to be in the hands of the Directors in New York as early as the fifteenth day of the succeeding month and that the problem of distances, the pecularities of foreign currency and temperaments, the nature of the business itself, and the small supply of accountants trained in the American manner to be found in these foreign countries, it will be understood that the task facing the Comptroller of the Company was no mean one.

A visit to the international port of entry at Miami, Florida, will persuade the casual observer that the accounting procedure in force is of the simplest. This observer, if he chances to be a passenger, is greeted at his train by a uniformed attendant and a specially designed automobile and carried to the beatifully-appointed passenger station at our airport in time for breakfast in the company restaurant. During breakfast he hears the purring of the three powerful Wasp engines in the Fokker airliner, as they are given the customary fifteen-minute warming up before the flight commences. After breakfast he notices the tractor bringing the sleek giant airplane alongside the passenger entrance and shortly thereafter sees the United States mail officials turning over the international mail to our representatives for loading. During this time his baggage is being checked and loaded on the airplane and at the stroke of the second gong, he and the other eleven passengers are conducted to the airplane and shown to their seats by a uniformed steward, who is waiting in the airplane with the pilot, the co-pilot, and the flight radio operator.

Shortly thereafter, the engines are started again, the cabin door is closed and the airplane is taxied to the end of the runway which has been chosen after consulting the prevailing wind. The Field

Manager, watch in hand, waits for the exact minute scheduled for the departure and then drops his flag, at which signal the pilot transforms the motionless vehicle into a swiftly accelerating machine which is soon lifted into the air on its two-hour flight over the magnificently-colored Straits of Florida to the airport in Havana. A smooth, well-oiled procedure, but you in this audience know as well as I do that weeks and months of thought and care have been devoted by the men responsible for the various phases of the operations of the company, with the thought always uppermost of providing the best and safest of methods that can be found.

*Mail Revenue*

The physical handling and accounting for foreign air mail has been carefully worked out and follows in part the forms adopted by most of the countries of the world.

Every day, United States mail airplanes arrive at our airport at Miami with mail posted the previous day in the Eastern, Southwestern and Middlewestern sections of the United States. This mail is delivered to the United States Post Office sub-station in our passenger terminal, where it is made up into separate despatches for each port of call for which the mail is destined. These despatches are assembled according to the route on which the ports of call lie and are turned over to our company in this manner, accompanied by a printed form known as a "Consolidated Waybill", one waybill accompanying each group of despatches. Along the top and down the margin of this document is printed a list of all the ports touched on the routes, so that the number of despatches and their destinations are shown merely by inserting numbers in the appropriate squares. A copy of this waybill is receipted and given to the postmaster at Miami as his official record. A second copy accompanies the mail load on the airplane and is receipted by the local postoffice representative at each port where mail is discharged.

As local foreign mail is loaded on the airplane in the course of the run, the number of the local despatches is indicated on the "consolidated waybill" accompanying the airplane and a receipt for such mail is given to the local post-office representative. At the end of the run, this waybill in its completed form gives a complete history of the mail transactions of the run and is tendered to

the representative of the United States Post Office as an evidence of the fulfillment of the requirements of the run, thus indicating to the United States Government that the monthly charge for service is properly substantiated.

A form known as a "Letter-Bill", which is standard throughout the entire world, accompanies each despatch of mail, and shows the weights of the mail and the details of every piece of registered mail included in the despatch. The mail in the despatch is checked at the port of destination against the copy of the letter-bill accompanying the despatch and in the event of any discrepancy, a form recognized by international treaty, known as a "Bulletin of Verification", is submitted to the port from which the mail originates, so that the difference may be rectified.

Mail originating in foreign countries is accompanied by what is known as a "Local Waybill", which shows the number and weights of the despatches, and their destinations. Summaries of these local waybills, prepared by the various airports, form the bases for the monthly charges against the foreign governments or colonies from which the mail originates.

*Passenger Revenue*

Owing to the fact that passenger space on airliners is limited, it is necessary that reservations for space in specific airplanes be made in the same general manner that Pullman reservations are made. The method used for reserving this space at our various agencies throughout the United States and of collecting for the sale of this space from the passengers, is as follows:

Our agent and brokers are supplied with forms known as "Exchange Orders", which are numbered and charged to them, being accounted for strictly at our central office by our Ticket Control Department. A person comes to our agency in Des Moines, Iowa, and states that he wishes to fly from Miami to Santo Domingo three weeks later. Our agent telegraphs to our traffic office in Miami, who reserves the space on the particular airplane leaving Miami on that future date, and confirms this reservation to the agent in Des Moines by telegraph. The agent sells the passenger two exchange orders, collecting at once for these orders, inasmuch as our service is what our friends from the Southern States call "cash and carry". The two passengers

present themselves to our traffic office in Miami on or before the day of departure and surrender their exchange orders for flight tickets, authorizing them to proceed as passengers over our established line from Miami to Santo Domingo. At the end of the month, the agent in Des Moines sends to our Ticket Control Office a monthly report of exchange orders sold, deducting his commission from the total amount and sending his remittance for the balance with the report.

Our tickets are numbered and are charged to the ticket sellers, who are credited for tickets issued, for cash or for exchange orders. The Ticket Control Office follows the course of every exchange order and ticket until its final return to the office, cancelled either through collection or surrender.

*Salaries*

Turning now to the subject of expenses of operation, the first item of importance is that of salaries. In this connection, the same problems are encountered as in other forms of industry, with the exception of the recognition of foreign service and of the flying time of pilots. As a rule, the salaries of pilots are classified in two groups, first, a standard base pay determined according to the operating policies of the company and according to local conditions, and second, flying pay based on mileage flown, divided in some instances into different rates for flying over water and for flying over land. This necessitates the keeping of accurate records for assembling the flying mileage attributable to the various individuals.

*Fuel*

Fuel is a large item and difficult physically to handle, owing to the necessity of storing it in foreign locations, where hitherto there had been little demand for it. When you figure that one Wasp engine turning its propeller at its normal rate of 1650 times a minute consumes approximately 22 gallons of gasoline per hour, that our Fokker 12-place airliners are powered with 3 Wasp engines, and that our schedules require that we fly the equivalent of the circumference of the globe every 48 hours, it will be seen that a strict accounting for our fuel is necessary. The time-honored perpetual inventory method comes into play here by means

of monthly fuel reports from our airports, listing the quantities used and the airplanes requisitioning the fuel.

*Insurance*

Insurance in the aviation industry is a study of its own, with technicians and underwriters, brokers and commissions, bending their entire efforts to the subject. Here we find problems not encountered elsewhere, problems not having the benefit of experience and precedent, spelling ruin to imprudent underwriters and financial weakening to under-insured or over-insured transport operators. The question of carrying crash insurance has worried many a Board of Directors, for they are compelled to consider rates varying between 7% and 20% per annum. Their cry is "Shall we pay these high premiums or shall we provide our own reserves? Would we rather spend money for this insurance or should we spend our equipment, which is rapidly becoming obsolete anyway? What will our crash loss be this year?" It is self-evident that companies with good accident records debate mightily before accepting these high rates, whereas those with poor records are naturally eager for the insurance, with the result that the rates reflect primarily the bad risks and not the industry as a whole.

Prudent air transport operators generally protect their interests by insuring against the liability of suit by passengers injured in accidents, by persons owning property damaged by flying equipment, by employees injured in the course of operations, and by persons injured by the flying equipment of other lines, operating on the company's fields. Premiums for passenger liability insurance are generally computed on the basis of a unit termed the "passenger-mile" the theory of this is that the hazard varies directly with the number of the passengers and the time in the air, converted into distance traveled. Our first passenger liability policy contained rates varying with the types of airplanes used, classified further as to the terrain over which the flights were made. A passenger-mile was not the equivalent of one passenger traveling one mile, but was the equivalent of one passenger traveling thirty seconds in an airplane with a rate cruising speed of 120 miles per hour and 36 seconds in an airplane with a rated cruising speed of 100 miles per hour. The mechanical difficulties of reporting passenger-miles under that policy were amplified by the

fact that we were carrying passengers in tri-motored, two-motored and single-motored land airplanes and amphibians, over flat land, Florida keys, mountains, jungles and oceans. Fortunately, the definition of "passenger-mile" was changed to the present sensible basis of "one passenger carried one mile" before we were "compelled" to purchase "lunacy" insurance on our computing staff.

Premiums for public liability and property damage insurance are naturally computed on a mileage basis, as the hazard varies with the time the airplane is in the air.

Fire insurance on airplanes is not to be passed over lightly, for what is the position if a fire and crash occur together; how much is a crash loss, collectible under the crash policy and how much is a fire loss? Companies carrying fire insurance but not crash insurance are vitally interested in this question.

The question often arises as to what effect flying has on life and accident insurance. In most cases life insurance is incontestable after having been in force for one year, which means that the fact that a person travels in an airplane has no effect on the insurance contract. Most reputable writers of accident insurance issue riders without cost, stating that the coverage, exclusive of double indemnity provisions, remains in force while the insured is a fare-paying passenger in a licensed passenger airplane provided by an incorporated passenger carrier and while operated by a licensed pilot upon a regular passenger route between definitely established airports. These conditions, while numerous, are those maintaining in the operation of most air transport lines, and are a fair example of what hard-headed insurance executives think concerning the safety of such operations.

*Depreciation*

I am fully aware that membership in your organization implies a complete acquaintance with the subject of depreciation and of its manifold problems, and I also know that some of the bitterest arguments in the accounting world have centered on depreciation.

This subject appears in a pressing form in the air transportation industry because of the large initial cost of the flying equipment and of the rapid rate of obsolescence. Some operators contend that depreciation on airplanes and engines does not exist, because

flying equipment must be perfect in order to fly, but all agree that obsolescence is steadily taking place.

With the radical and rapid changes in design, methods of construction, passenger-carrying capacity, and other engineering improvements which render uneconomical the operation before the equipment has actually worn out, it becomes necessary to provide full depreciation and obsolescence reserves in between two and four years, the time varying in accordance with the maintenance and safety policy of the individual company, and the opinion of the Board of Directors.

The logical method of computing depreciation on flying equipment is to estimate the number of hours that the average airplane will fly during the determined period of depreciation and to use this estimate as representing the useful flying life of the equipment, recording depreciation on the basis of actual hours in operation. Inasmuch as engines are run on the test stand and are also warmed up for several minutes before each flight and often allowed to run for several minutes after each flight, it is seen that the time of service varies as to the airplanes and the engines in the airplanes.

The mechanical device for accumulating the hours of service is the log-book with which each airplane and engine is supplied. In these books are recorded the life history of the equipment, including the dates and time consumed in service together with brief descriptions identifying the flights. A recapitulation of these log books together with a knowledge of the original cost of the equipment and the estimated useful hours of service is sufficient to determine the monthly charge for depreciation.

The policy of recording a reserve for crash loss by those companies who elect to insure themselves against crash is affected largely by the policy of recording depreciation and obsolescence. Thus a high rate of depreciation would presuppose a lower rate for calculating the estimated crash loss as it would penalize operations unduly if the cost of the equipment were reserved against excessively. However, the reserve for crash loss is in reality a surplus reserve, providing monthly for estimated future calamities.

A word as to the units used in the preparation of cost figures will be of interest. Companies engaged in the manufacture of airplanes and equipment naturally use established manufacturing

units; companies engaged in special work such as photography, crop-dusting, and charter flights often use the contract as the unit and air transport operators use units varying with conditions obtaining in their particular line of endeavor.

The unit of cost commonly used in the United States is that of the statute mile, due primarily to the ease with which it can be applied and also to the fact that in many cases, passenger, baggage, and express revenue vary directly with the mileage. In some cases mail revenue is based on an established figure per mile, and many forms of expense such as flying pay of pilots, fuel, maintenance, and depreciation of flying equipment vary according to the hours of service, which is readily converted into statute mileage.

In some of the countries on the continent, the unit of cost is the useful-load-mile, which corresponds to the foot-pound used by physicists. In cases where different types of airplanes are used in the same form of service, this unit is of value in portraying the relative efficiency of the airplanes and in determining at what points there is remissness in the matter of expense.

In certain other countries, the horsepower-mile is used, wherein the total rated horsepower of the engines in airplanes is used as the unit of cost on the theory that each horsepower should be able to support a definite useful load. Thus it is seen that this is comparable to the unit of useful-load-mileage, previously mentioned.

This subject of units of cost employed by the operators of air transport lines is so new that there is no uniformity, nor can there be until the problems are thoroughly studied and given the test of time.

*Handling Operating Accounts*

A few words concerning the organization of the accounts of our operating companies will show a carefully thought-out plan of assembling the operating data from the many points where our operations take place. The problem of distances from the operating airports to the base airport and the natural delay in the receipt of statistical information has been overcome in two ways; first, by the use of our airplanes in transmitting accounting information, and second, by the staggering of monthly closing dates at far distant points in such a manner that these points forward their monthly information before the end of the month, closing

their records for the month sometimes as early as the 25th of the month. In this manner, reports from all of the stations arrive at the central point on or about the same time and are consolidated into the general picture without confusion. Discrepancies, misunderstandings, and other differences are rectified at once with little cost or delay by means of our efficient radio system, with its sending and receiving stations dotted here and there in the countries encircling the Caribbean Sea.

The airports are supplied with revolving cash funds, which are reimbursed periodically on the strength of comprehensive cash reports which form the basis for the entries in the general books and for the preparation of the detailed cost figures.

Cash receipts at the airports and traffic offices are remitted intact with appropriate cash reports to the main accounting office and due credit is given on the general books of the company and on the financial statements.

By the use of these methods of accounting, income and expenditures at the various airports are carefully classified, and those individuals responsible for financial transactions are aware of the fact that their disbursements are plainly recorded as such and the results of operations are checked carefully against the departmental budgets applicable to the individual airports.

We are thus in the admirable position of being able to watch the results of those individuals responsible for these results, which is, after all, an elemental requisite of successful accounting.

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